جامعة طرابلس كلية تقنية المعلومات الامتحان النهائي المقرر: تحليل عددي		رمز المقرر : ITGS219 ربيع 2021 / 2022 الزمن: ساعتان الدرجة الكلية: 50 درجة

رقم القيد : .... الاسم: .... المجموعة:.........

السؤال الأول (10 درجات): ضع علامة صح (√) او خطاء (×) امام كل عباره **True or False question:**

1. The False Position method is a combination of the secant method and bisection method. (   )
2. If we can begin with a good choice x_0, then: Newton's method will converge to x_r slowly and slower than the secant and the Regula Falsi methods. (   )
3. The matrix a= [1, 2, 3; 2, 4, 6] is the output of the next code (   )

```
for k = 1:3
   for m = 1:2
          a(m,k) = m*k
   end
end
```

4. The MATLAB command ***root*** is used to calculate the values of y when x = 0. (   )
5. The MATLAB command ***polyfit(x, y, N),*** returns the coefficients of for the polynomial of degree ***N*** and data points ***x*** and ***y.*** (   )
6. This piecewise polynomial is a quadratic spline: $S(x) = \begin{cases} S_0(x) = 0\,; & -1 \le x \le 0 \\ S_1(x) = x^2\,; & 0 \le x \le 1 \end{cases}$ (   )
7. Extrapolation is the process of finding the value of *f(x)* corresponding to any untabulated value of *x* between x_0 and x_n. (   )
8. After executing the next two Matlab commands y vector will contain the values y= [4, 6, 8]. (   )

```
>> x = linspace(2,10,5);
>> y = x(2:end-1);
```

9. In Cubic spline, since *f(x)* is cubic in each of the subintervals, so that, $f''(x)$ shall be linear and continuous at each point. (   )
10. The Taylor series of a function is an infinite sum of terms that are expressed in terms of the function's derivatives at a single point. (   )

السؤال الثاني (20 درجات): أختار الإجابة الصحيحة :**choose the right answer**

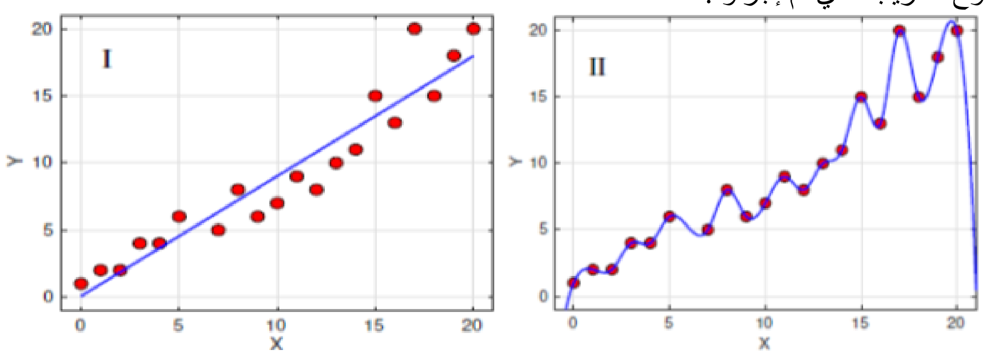
1) Why this piecewise polynomial is NOT a cubic spline? لماذا متعددة الحدود هذه ليست cubic spline؟

$$S(x) = \begin{cases} S_0(x) = 2\,; & 0 \le x \le 1 \\ S_1(x) = 2 + (x-1)^2\,; & 1 \le x \le 2 \end{cases}$$

(A) $S_0(1) \neq S_1(1)$ (B) $\acute{S}_0(1) \neq \acute{S}_1(1)$ (C) $S_0''(1) \neq S_1''(1)$

2) For each plot, identify the type of approximation that has been performed:

لكل رسمة، حدد نوع التقريب الذي تم إجراؤه:



(A) I = interpolation, II = curve fitting (B) I = curve fitting, II = interpolation (C) I = interpolation, II = extrapolation

3) If the step size h between N data points is constants, so that, we can use this Lagrange method to find the polynomial.

إذا كان حجم الخطوة h بين نقاط البيانات N عبارة عن ثوابت، فلا يمكننا استخدام طريقة Lagrange لإيجاد كثيرة الحدود.

(A) True (B) False

4) Consider the fixed point iteration $x_{k+1} = g(x_k)$ with $g(x) = \frac{x}{3} + \frac{4}{3x}$ Which root- finding problem is this equivalent to *f(x)=0*?

اعتبر تكرار النقطة الثابتة $x_{k+1} = g(x_k)$ مع $g(x) = \frac{x}{3} + \frac{4}{3x}$ أي من مسائل ايجاد الجدور تكافئ *f(x)=0* ؟

(A) $x^2 - 2 = 0$ (B) $\frac{x}{3} + \frac{4}{3x} = 0$ (C) $\frac{1}{3} - \frac{4}{3x^2} = 0$

5) The coefficients of the polynomial $f(x) = 3x^3 - 7x^4 + x^5 - 6x^2 + 1$ are:

(A) c=[-7 1 -6 1] (B) c=[3 0 1 -7 0 -6 0 1]

6) The linear Lagrange polynomial that interpolates the points (1; 3) and (4; 5) is:

كثير حدود Lagrange الخطي الذي يقحم النقاط (1 ؛ 3) و (4 ؛ 5) هو:

(A) $P(x) = -x + \frac{5}{3}x$ (B) $P(x) = \frac{-9}{x-4} + \frac{15}{x-1}$ (C) $P(x) = \frac{1}{3}(2x - 7)$

7) Fill in the blanks in the table with Newton backward difference:

املأ الفراغات في الجدول باستخدام Newton backward

x	y		
1	1		
		a	
3	9		c
		b	
4	16		

(A) a = 4, b = 7, c = 1 (B) a = 8, b = 7, c = 3 (C) a = 8, b = 7, c = -1

8) The output of the next code is:

(A) 11 (B) 6 (C) 11.5 (D) 1 2 3 …10

```
x = 1;
while 1 == 1
      x = x+2.5;
      if x > 5
         disp(x)
         break
       end
end
```

9) You are provided with table of points for the function $f(x) = x + 10 - e^x$:

Use this data to perform two steps of the bisection method for solving $f(x) = 0$, assuming the nitial interval [0; 4]. What is the approximation of the root?

لديك النقاط التالية حسب الجدول للدالة $f(x)=x+10-e^x$ استخدم هذه البيانات بإجراء خطوتين بطريقة التنصيف لحل المعادلة $f(x) = 0$ بفترة ابتدائية [0; 4] . ماهو جدر المعادلة بعد الخطوتين:

x	0	1	2	3	4
$f(x)$	9.000	8.282	4.611	-7.086	-40.598

(A) 1 (B) 2 (C) 3 (D) 4

السؤال الثالث (10 درجات):

Fit a straight line to the following data:

قم بملاءمة خط مستقيم للبيانات التالية:

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

Also estimate the value of y, when x=10.

السؤال الرابع (10 درجات):

Given the values اذا اعطيت القيم التالية

x:	5	7	11	13	17
$f(x)$:	150	392	1452	2366	5202

evaluate $f(9)$, using *Lagrange's formula* *اوجد قيمة* $f(9)$ *باستخدام*

................................انتهت الأسئلة، مع تمنياتي للجميع بالتوفيق..

Reference مرجع:

$$f(x+h)=f(x)+f'(x)h+\frac{f''(x)}{2!}h^2+\frac{f'''(x)}{3!}h^3+\cdots$$

True Error (E_t)= True value – approximate value

$$x_{i+1}=x_i-\frac{f(x_i)}{f'(x_i)}$$

$$c=\frac{a+b}{2}$$

$$x_{n+1}=x_n-\frac{x_n^m-a}{mx_n^{m-1}},$$

$$x_{i+1}=x_i-\frac{f(x_i)(x_i-x_{i-1})}{f(x_i)-f(x_{i-1})}$$

$$x_2=x_0-f(x_0)\frac{x_1-x_0}{f(x_1)-f(x_0)}.$$

$$P(x)=y_0+\frac{\Delta y0}{h}(x-x0)+\frac{\Delta^2 y0}{2!h^2}(x-x0)(x-x1)+\ \ldots+\frac{\Delta^n y0}{n!h^n}(x-x0)(x-x1)\ldots(x-xn-1)$$

$$P(x)=y_n+\frac{\nabla yn}{h}(x-xn)+\frac{\nabla^2 yn}{2!h^2}(x-xn)(x-xn-1)+\ \ldots+\frac{\nabla^n yn}{n!h^n}(x-xn)(x-xn-1)\ldots(x-x1)$$

$$f(z)\approx\sum_{i=1}^{N}f_i\prod_{\substack{j=1\\ j\neq i}}^{N}\frac{z-x_j}{x_i-x_j}.$$

$$a=\frac{N\sum x_if_i-\sum x_i\sum f_i}{N\sum x_i^2-\left(\sum x_i\right)^2}$$

$$b=\frac{\sum f_i}{N}-\mathrm{a}\frac{\sum x_i}{N}=\bar{f}-a\bar{x}$$